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(71) Applicant(s)

Samsung Electronics Co., Ltd.  
(Incorporated in the Republic of Korea)  
416 Maetan-dong, Paldal-gu, Suwon-city,  
Kyungki-do, Republic of Korea

(72) Inventor(s)

Sang-aeo Lee

(74) Agent and/or Address for Service

Appleyard Lees  
15 Clare Road, HALIFAX, West Yorkshire, HX1 2HY,  
United Kingdom

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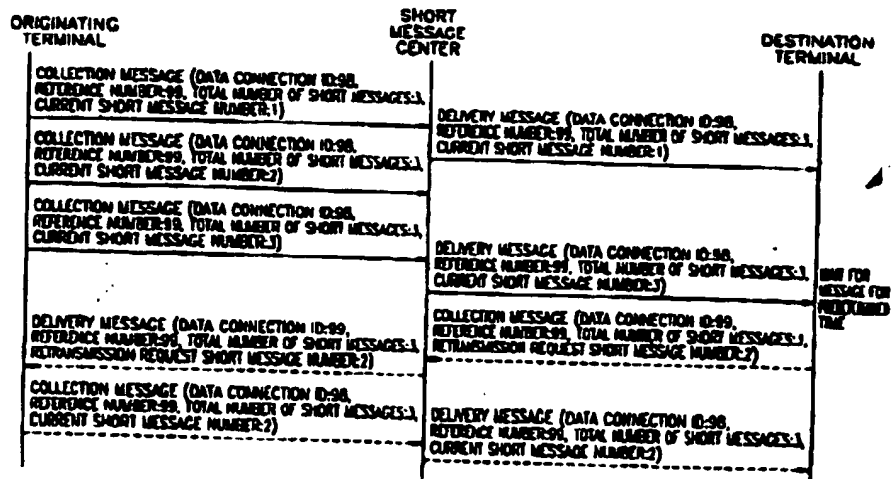
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(54) Abstract Title

Protocol segments large message data for transmission using short message service (SMS)

(57) To enable transmission of a relatively large volume of data, such as a simple picture, while using a short message service (SMS), a data transmission protocol segments the data message into a plurality of short message data fields. The data transmission protocol includes the steps of segmenting input message data into a plurality of short message data fields and inserting into a user data field (602, fig 6) a data connection service identifier, a segmented message data field, a field indicating the total number of short message segments and a field indicating a current short message segment number. A short message field (60, fig 6) is then generated using the user data field (602, fig 6) and transmitted. The data message is thus transmitted in segments by a plurality of short message fields. A destination terminal is able to determine from the data connection service identifier that a message is being transmitted in segments so that rather than perform normal short message processing, the terminal waits to receive all the required message fields, as indicated by the total number and if it determines that a message field has not been received, uses the individual number fields to determine which message field is missing and request retransmission of the appropriate message field.

FIG. 7B



GB 2 349 302 A

FIG. 1 (PRIOR ART)

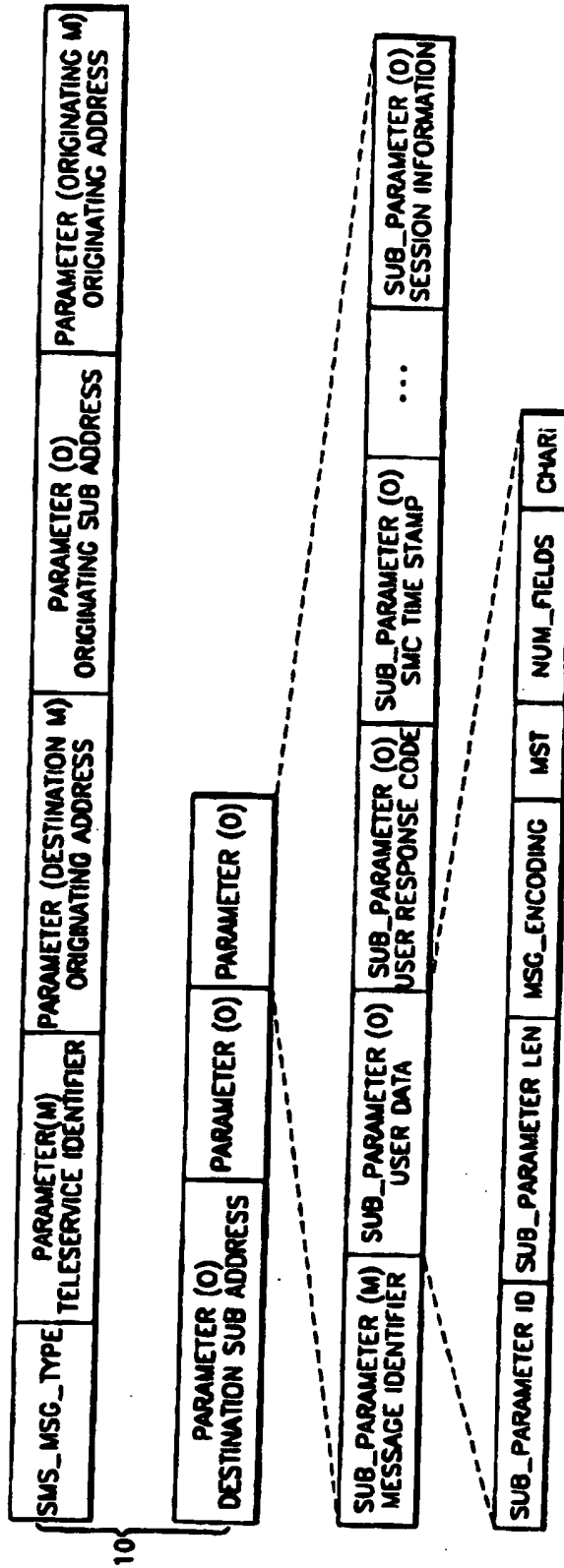


FIG. 2 (PRIOR ART)

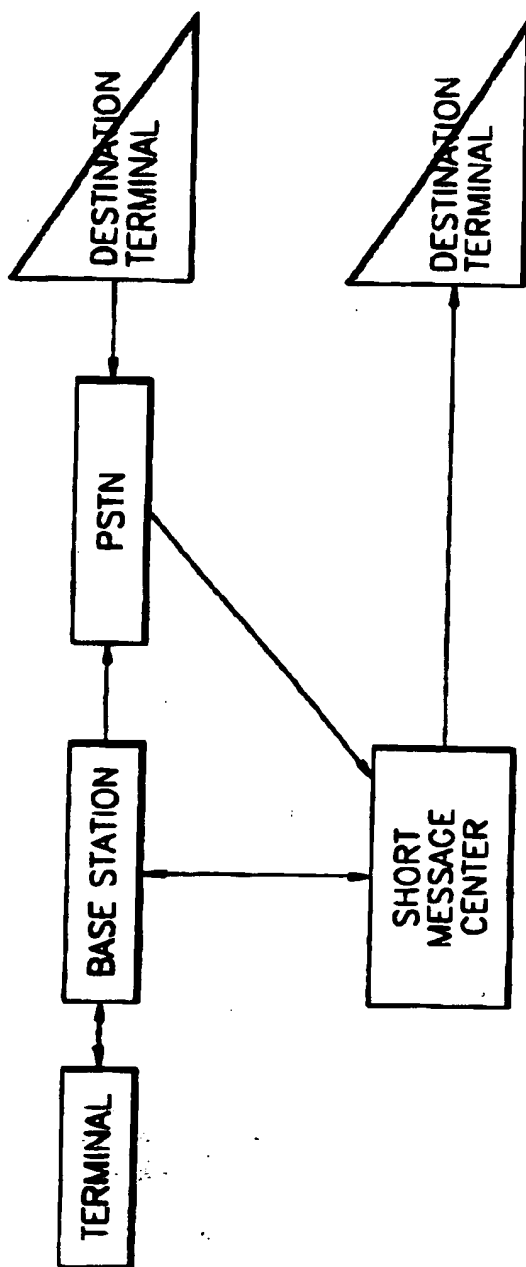


FIG. 3A (PRIOR ART)

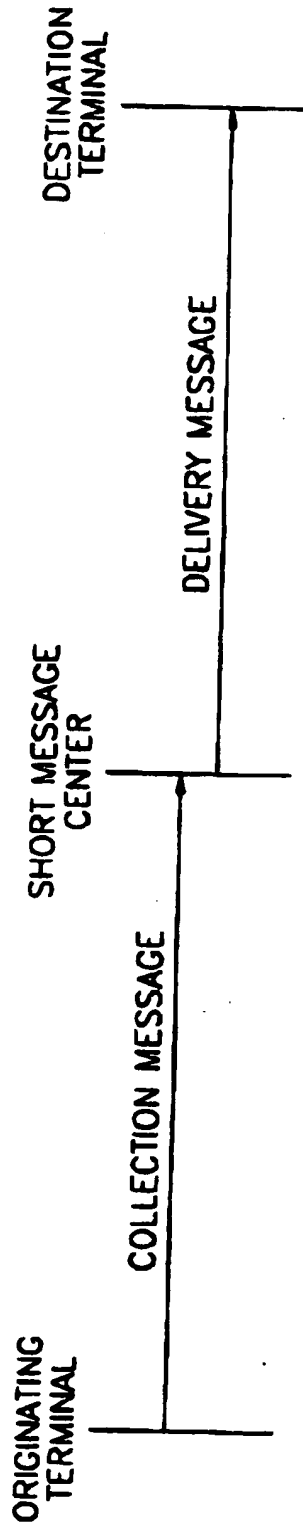


FIG. 3B (PRIOR ART)

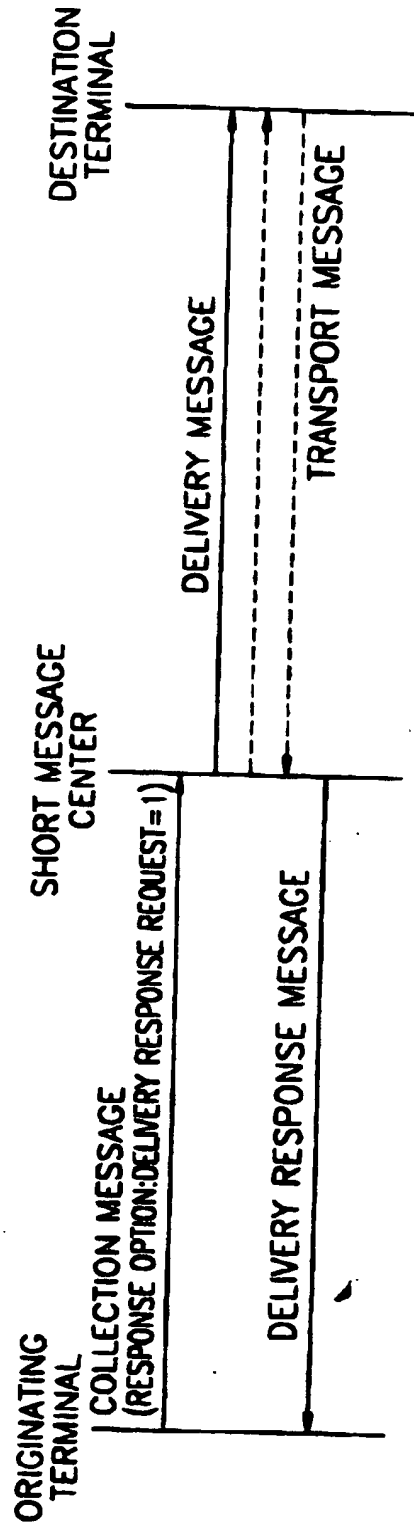


FIG. 3C (PRIOR ART)

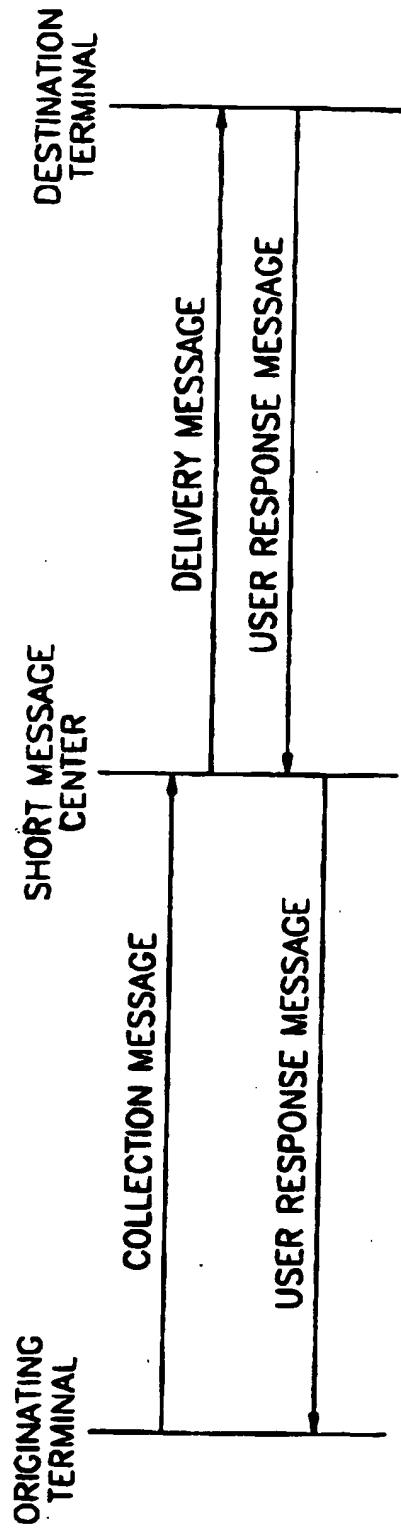


FIG. 4

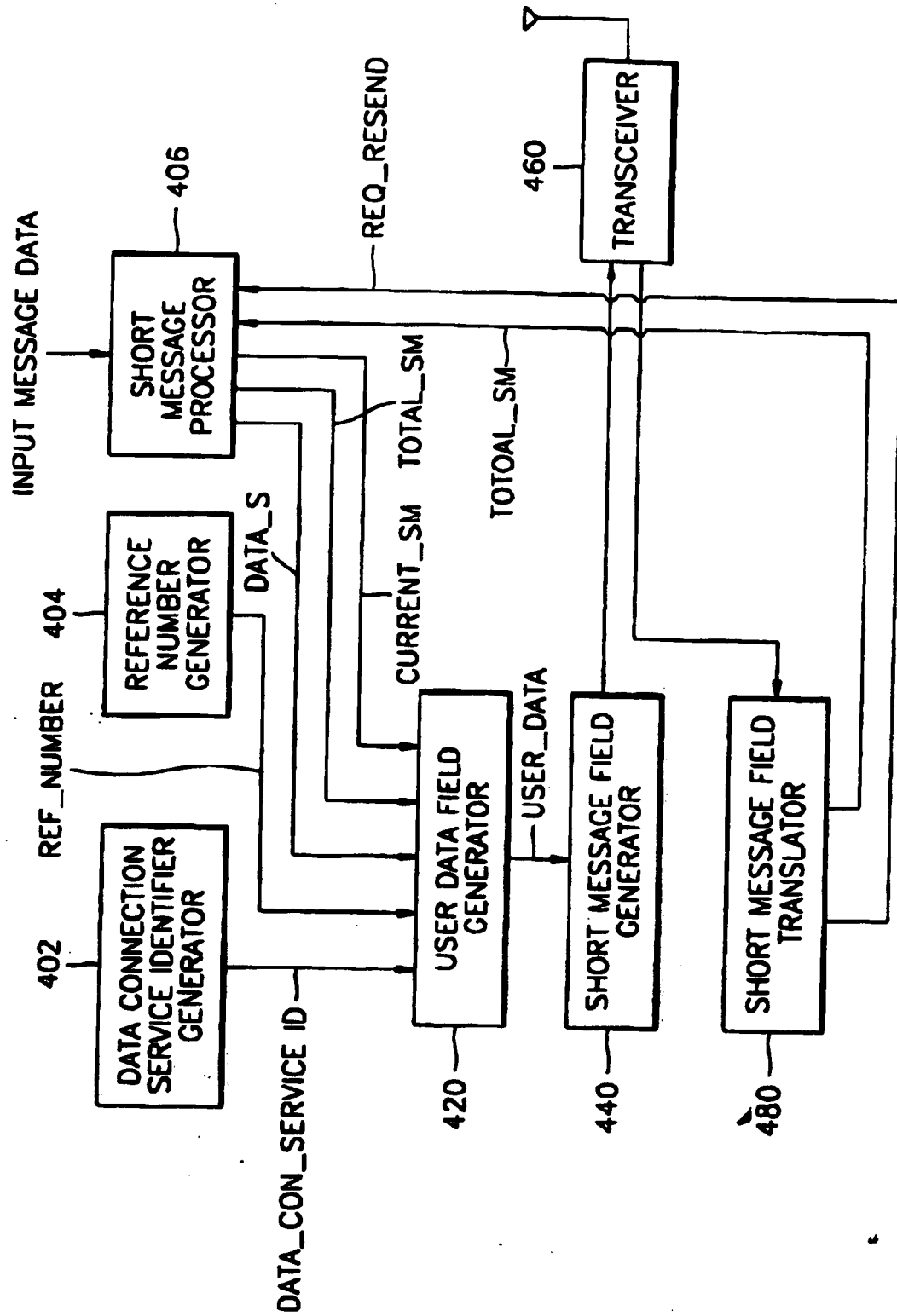


FIG. 5

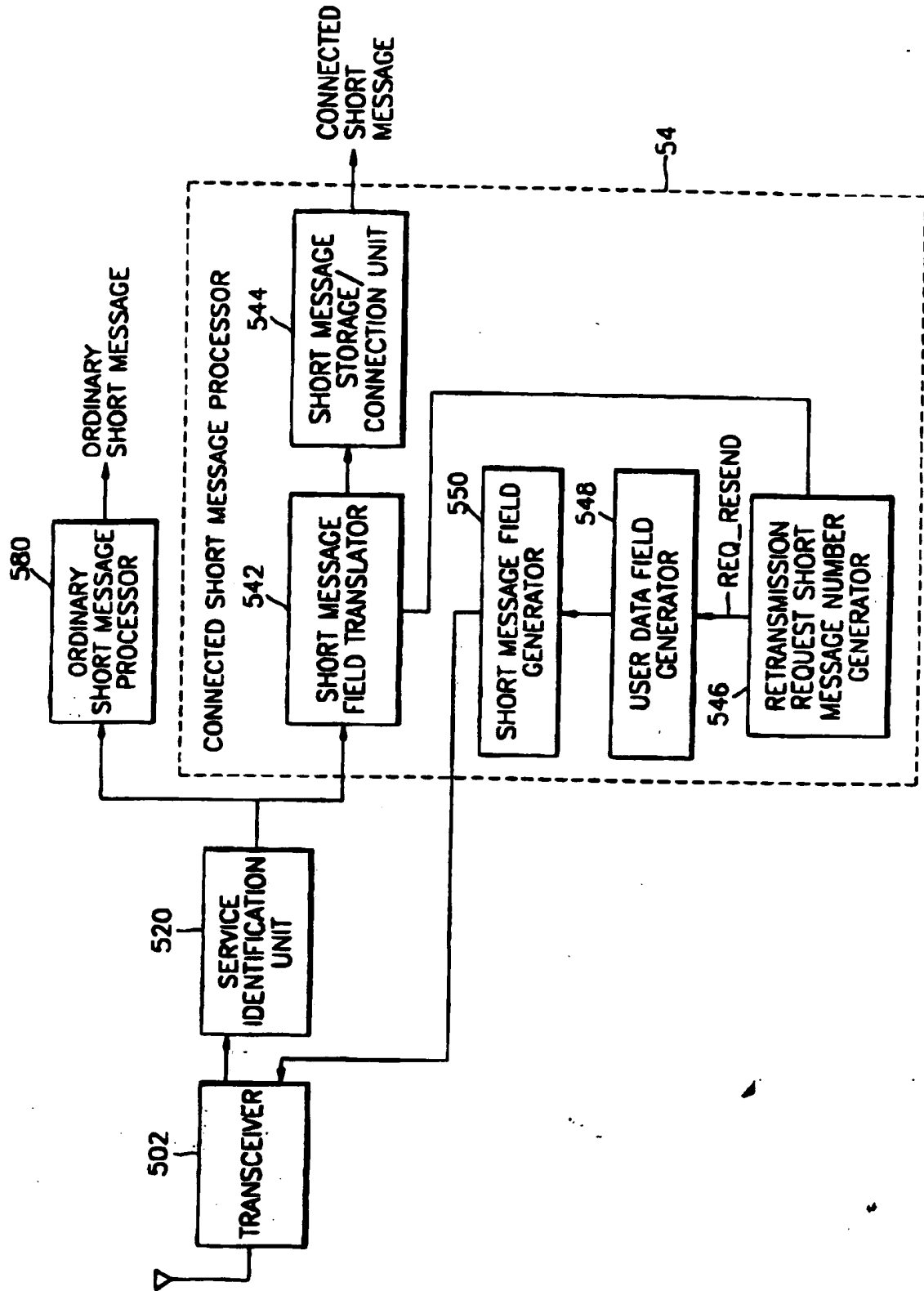


FIG. 6

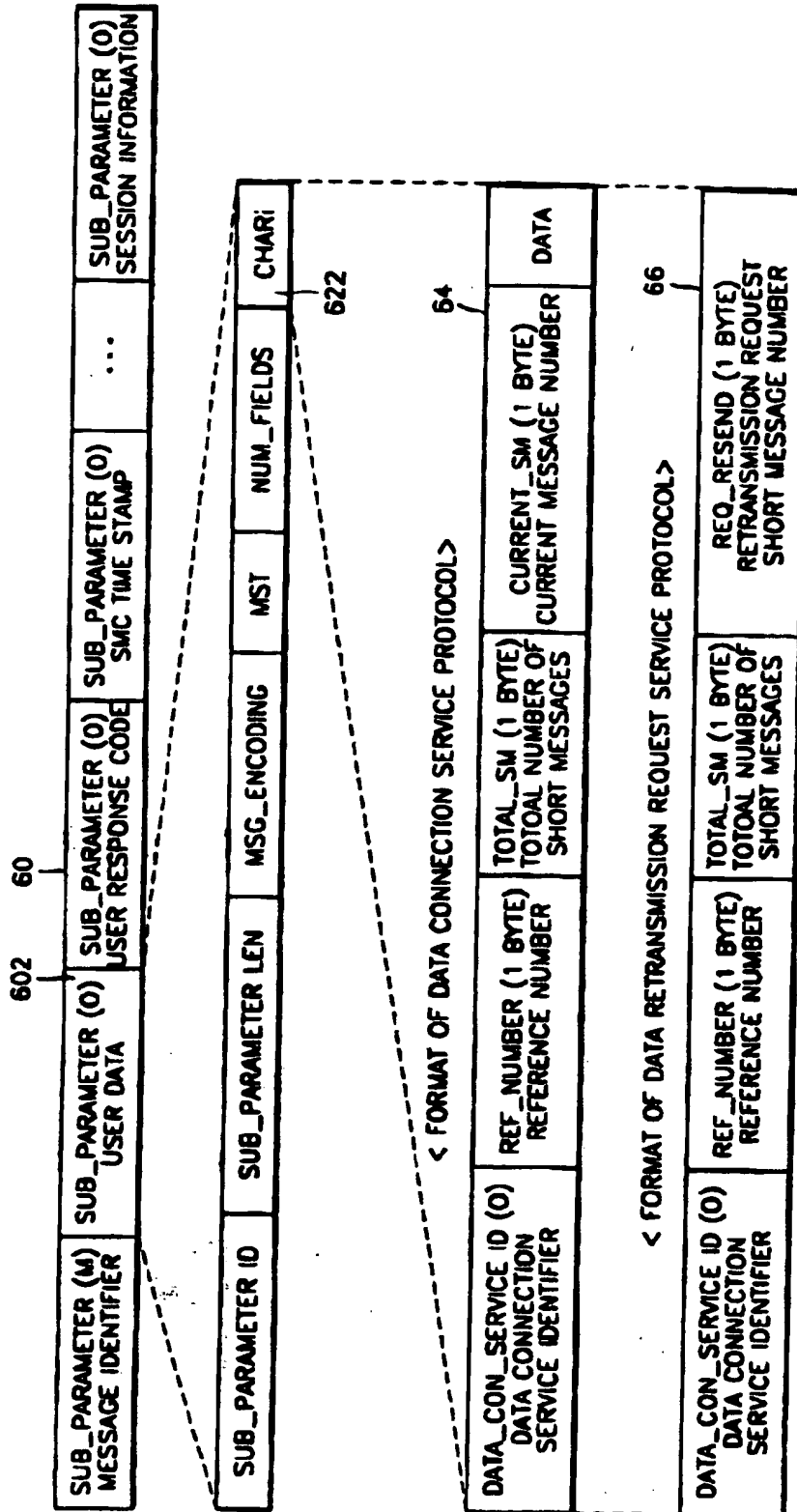




FIG. 7A

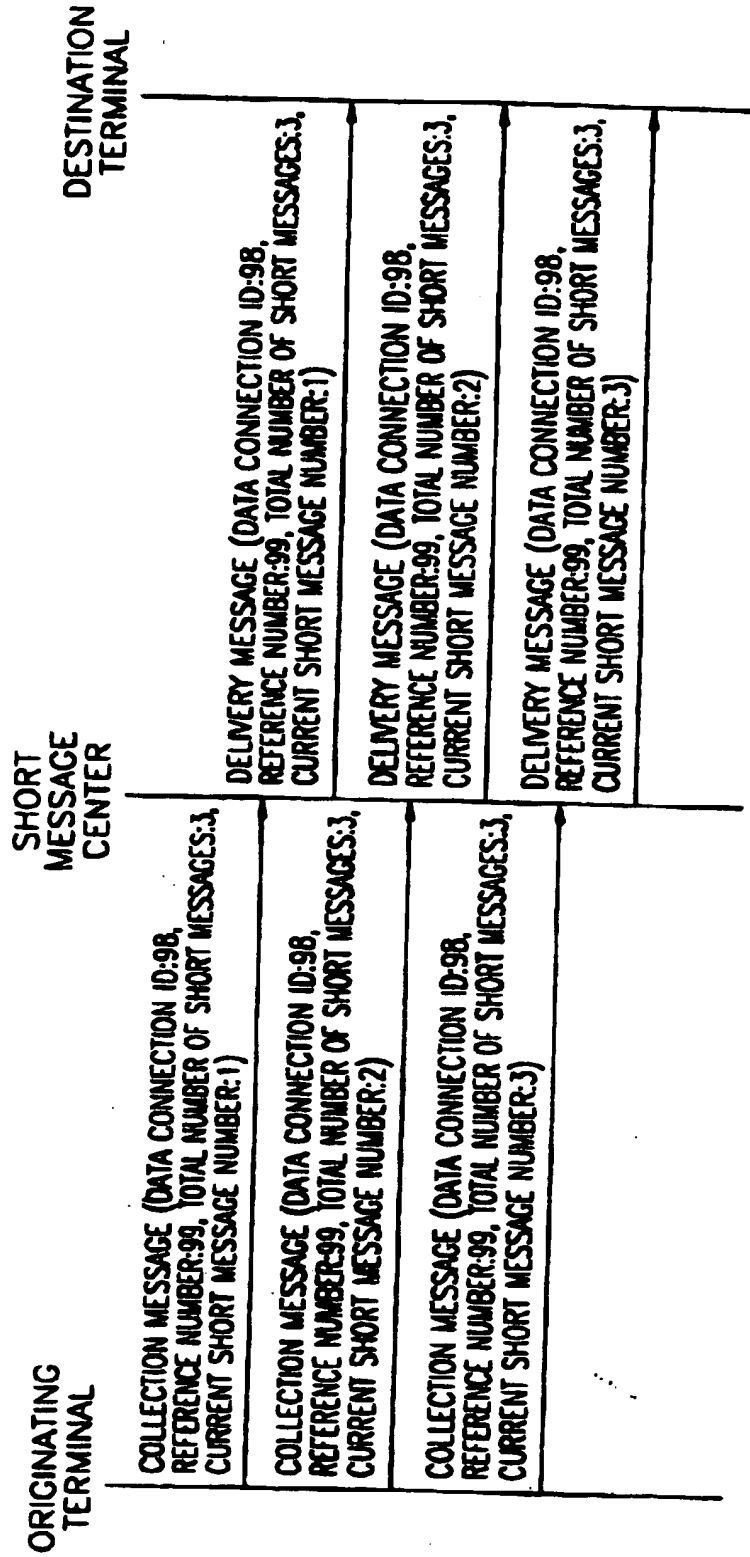
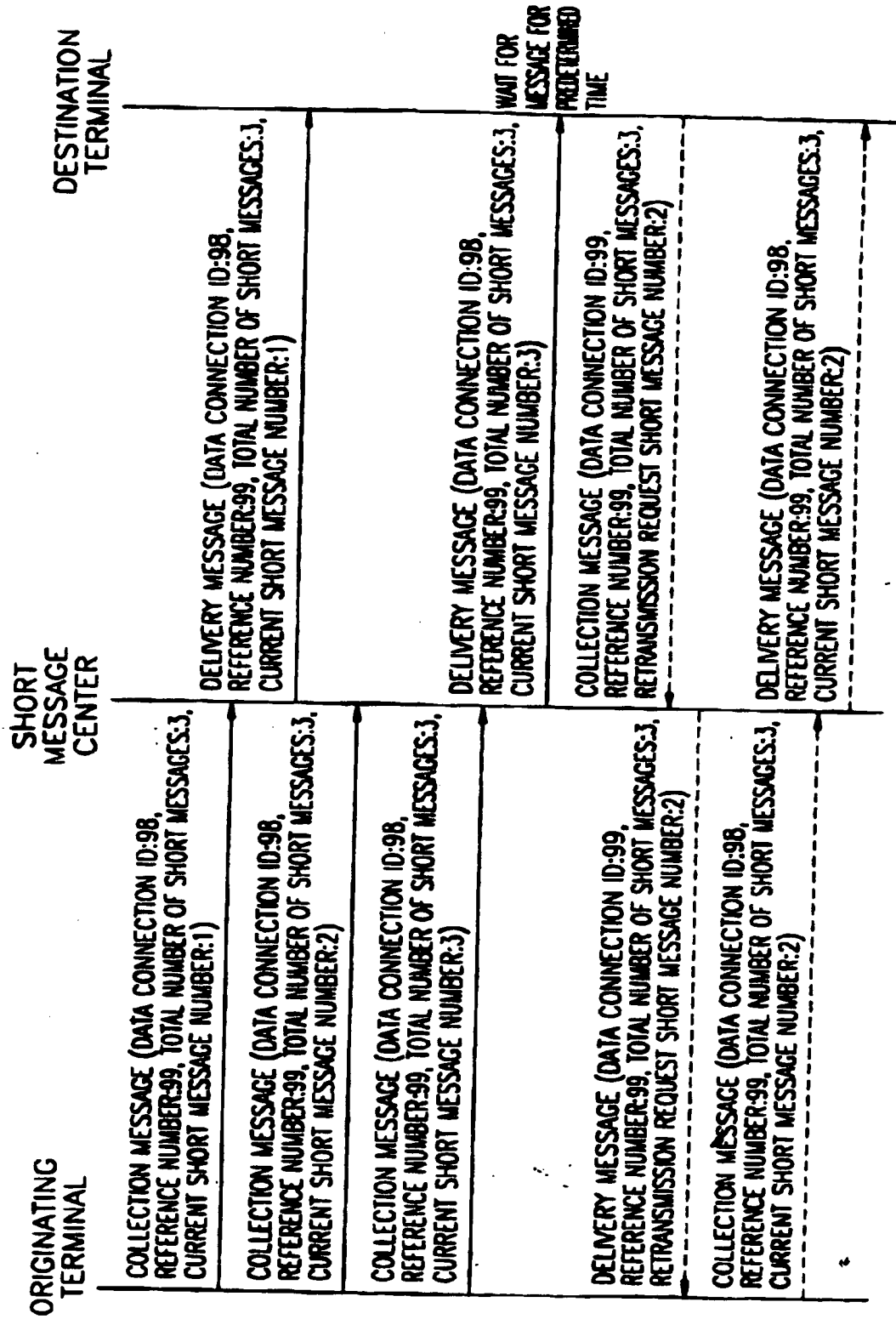


FIG. 7B



## DATA TRANSMISSION PROTOCOL USING SHORT MESSAGE SERVICE

5       The present invention relates to a data transmission protocol and an apparatus performing transmission according to the data transmission protocol, and more particularly, to a data transmission protocol and apparatus using a short message service.

10

Figure 1 shows the format of a short message frame which is used in a conventional short message transmission protocol. Figure 2 is a diagram for explaining the procedure of message transmission according to the  
15       protocol. Figures 3A through 3C are diagrams for explaining examples of the procedure of transmitting a short message according to a conventional short message protocol. Figure 3A shows the procedure of short message transmission when a collection message does not have a  
20       response option. Figure 3B shows the procedure of short message transmission when a collection message has a delivery response option. Figure 3C shows the procedure of short message transmission when a collection message does not have a delivery response option.

25

According to a conventional short message transmission protocol, a user creates a message of an appropriate length using an originating terminal and inputs a send command instructing the originating terminal to transmit  
30       the message. The originating terminal then attempts short-message transmission by sending a field 10 in the form of a short message as shown in Figure 1 to a base station in response to the send command. Short messages from a

plurality of sending terminals are collected and delivered to a short message center by the base station. Accordingly, a short message which is sent from an originating terminal is referred to as a collection message. The short message center checks a destination terminal address of the received collection message and transmits the short message in the form of a delivery message to a destination terminal corresponding to the address. The collection message may not have a delivery response request option as shown in Figure 3A. In this case, when the collection message from an originating terminal is converted into a delivery message format in a short message center and transmitted to a destination terminal, response to the delivery is not requested. As shown in Figure 3B, a collection message may have a delivery response request option. In this case, an originating terminal adds the delivery response request option to the field format of the collection message before transmission to a short message center. The short message center separately transmits a transport message along with a delivery message when it is determined that the collection message has a delivery response request option. A destination terminal then receives the delivery message and sends the transport message, which has been transmitted from the short message center, to the short message center as it is. When the transport message from the destination terminal arrives at the short message center, the short message center sends a delivery response message to the originating terminal.

30

Figure 3C shows another case in which a collection message does not have a delivery response request option. In this case, the collection message from an originating

terminal is converted into a delivery message format in a short message center and then transmitted to a destination terminal. Once the destination terminal receives the delivery message, it sends a user response message to the short message center. When the user response message arrives, the short message center sends the user response message to the originating terminal.

Meanwhile, it happens that a short message cannot be transmitted to a destination terminal in such a case where the destination terminal cannot perform reception, a short message center is overloaded, or an air wave environment is poor. To measure the above problem, retransmission is periodically performed or performed when necessary according to a transmission state. Time intervals of retransmissions or the number of retransmissions may be different depending on a parameter of a received short message.

However, according to a conventional short message transmission protocol, the length of a short message is limited to a predetermined length when transmitting or receiving a message. Consequently, data service is very limited. Recently, large-sized screens of liquid crystal display units have been developed, but the conventional short message transmission protocol cannot efficiently utilize the developed devices. To solve these problems, a new data transmission protocol may be applied, but there is a problem in changing message service centers.

It is an aim of at least preferred embodiments of the present invention to provide a data sending protocol that allows message data, which is longer than a conventional

transmittable message data, to be transmitted while using a conventional short message service.

5 It is another aim of at least preferred embodiments of the present invention to provide a data reception protocol for receiving short messages in response to the above data sending protocol.

10 It is yet another aim of at least preferred embodiments of the present invention to provide a data sending apparatus for performing an expanded data service using the data sending protocol.

15 It is still yet another aim of at least preferred embodiments of the present invention to provide a data receiving apparatus for performing an expanded data service using the data reception protocol.

20 According to a first aspect of the present invention, there is provided the data transmission protocol including the steps of (a) inserting a data connection service identifier into a user data field; (b) segmenting input message data into a plurality of short message data fields and inserting a segmented message data field, a field  
25 indicating the number of segmented short messages and a field indicating a current short message number, into the user data field; (c) generating a short message field using the user data field; and (d) transmitting the short message field.

30

Preferably, the step (a) uses a code, which is not used in a KS5601 standard or an ASCII code table, for the

data connection service identifier, and the code is 98H or 99H.

Preferably, the data sending protocol also includes a  
5 step of (e) inserting a reference number field, which indicates a number for referring to the type of data connection service, into a position next to the data connection service identifier in the user data field.

10 Preferably, the data sending protocol additionally includes a step of (f) translating a delivery message and extracting an identifier requesting retransmission of data.

15 Preferably, the step (f) includes the steps of (f-1) extracting a field indicating the total number of short message and a field indicating a retransmission request short message number; (f-2) inserting, among the whole segmented short messages, a short message data field  
20 corresponding to the retransmission request short message number, into a user data field; and (f-3) generating a short message field using the user data field and retransmitting the short message field.

25 Also according to the present invention there is provided a data receiving protocol using short message service. The data receiving protocol includes the steps of (a) checking a user data field of a delivery short message to extract a data connection service identifier;  
30 if the data connection service identifier satisfies a predetermined condition, (b-1) translating data in a short message area among the user data field of the delivery message; and (b-2) storing and connecting a plurality of

translated data; or if the data connection service identifier does not satisfy a predetermined condition, (c) performing an ordinary short message process.

5        Preferably, the step (b-1) includes a step of (b-1-1) extracting a field indicating the total number of short message and a field indicating a current short message number, and the step (b-2) comprises a step of (b-2-2) outputting the connected data to a higher processing layer  
10    after storing and connecting as many data fields as the total number of short message.

       Preferably, if extraction of the data in the short message area fails in the step (b-1), the data receiving  
15    protocol also includes the steps of inserting a short message number of a field, in which extraction of the data fails, into a user data field as a retransmission request short message number; generating a short message field using the user data field; and transmitting the short  
20    message field.

       Preferably, the step (a) extracts a code, which is not used in a KS5601 standard or an ASCII code table, as the data connection service identifier, and the code is 98H or  
25    99H.

       According to a third aspect of the present invention there is provided a data sending apparatus using a short message service. The data sending apparatus includes a  
30    data connection service identifier inserting unit for inserting a data connection service identifier into a user data field; a short message processing unit for segmenting input message data into a plurality of short message data



fields and inserting a segmented message data field, a field indicating the number of segmented short messages and a field indicating a current short message number, into the user data field; a short message field generating  
5 unit for generating a short message field using the user data field; and a transmitting unit for transmitting the short message field.

According to a fourth aspect of the present invention  
10 there is provided a data receiving apparatus using short message service. The data receiving apparatus includes a service identifying unit for checking a user data field of a delivery short message to extract a data connection service identifier, outputting a control signal having a  
15 first logic level if the data connection service identifier satisfies a predetermined condition, and, if not, outputting a control signal having a second logic level; a short message field translating unit for translating data in a short message area among the user  
20 data field of the delivery message, in response to the control signal having the first logic level; a short message storage/connection unit for storing and connecting a plurality of translated data; and an ordinary short message processing unit for performing an ordinary short  
25 message process in response to the control signal having the second logic level.

For a better understanding of the invention, and to show how embodiments of the same may be carried into  
30 effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

Figure 1 is a diagram for showing the format of a short message frame which is used in a conventional short message transmission protocol;

5. Figure 2 is a diagram for explaining the procedure of message transmission according to a conventional short message transmission protocol;

10 Figures 3A through 3C are diagrams for explaining examples of the procedure of transmitting a short message according to a conventional short message protocol;

15 Figure 4 is a block diagram of a data sending apparatus using a short message service according to an embodiment of the present invention;

20 Figure 5 is a block diagram of a data receiving apparatus using short message service according to an embodiment of the present invention;

25 Figure 6 is a diagram for showing a data field format for application of a data transmitting protocol using short message service according to an embodiment of the present invention;

30 Figure 7A is a diagram for explaining an example of message transmission procedure performed by a short message transmission protocol using the short message service according to an embodiment of the present invention; and

Figure 7B is a diagram for explaining an example of message transmission procedure performed by a data

transmission protocol according to an embodiment of the present invention.

The present invention will now be described more fully  
5 with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. Figures 4 and 5 show a data sending apparatus and a data receiving apparatus according to embodiments of the present invention, respectively. Figure 6 shows a data field  
10 format for implementation of a data transmission protocol for use operated in the data sending apparatus and the data receiving apparatus and is referred to as necessary hereinafter.

15 Referring to Figure 4, the preferred data sending apparatus includes a data connection service identifier generator 402, a reference number generator 404, a short message processor 406, a user data field generator 420, a short message field generator 440, a transceiver 460 and a  
20 short message field translator 480.

In the operation of the data sending apparatus, primarily, the data connection service identifier generator 402 generates a code, which is not used in the  
25 KS5601 standard or an ASCII code table, such as 98H or 99H as a data connection service identifier DATA\_CON\_SERVICE ID (0). The reference number generator 404 generates a 1 byte of reference number field REF\_NUMBER, which represents a number for referring to the type of data  
30 connection service. The short message processor 406 segments input message data into a plurality of message data fields and outputs segmented message data fields DATA\_S, a field TOTAL\_SM indicating the number of

segmented messages and a field CURRENT\_SM indicating a current message data number. The user data field generator 420 inserts DATA\_CON\_SERVICE ID (0), REF\_NUMBER, DATA\_S, a field TOTAL\_SM into the user data field 602, and outputs  
5 the user data field 602. The short message field generator 440 generates a short message field 60 based on the user data field 602. The transceiver 460 transmits the short message field 60 over a channel.

10 When a short message transmitted over a channel does not normally arrive at a destination terminal because the air wave state is poor or the short message center is overloaded, a destination terminal (not shown) can send a delivery message for requesting retransmission. The  
15 transceiver 460 receives the delivery message sent from the destination terminal.

The short message field translator 480 translates the delivery message output from the transceiver 460 and  
20 extracts an identifier indicating the request of data retransmission. If the retransmission request identifier is extracted, the short message field translator 480 extracts a field TOTAL\_SM indicating the number of entire short messages and a field REQ\_RESEND indicating the  
25 number of a short message which is requested to be retransmitted.

The short message processor 406 receives the field TOTAL\_SM indicating the number of entire message data  
30 fields and the field REQ\_RESEND indicating the number of retransmission request message data field, from the short message field translator 480, and outputs a message data field DATA\_S corresponding to the retransmission request

short message number. The short message processor 406 includes a short message storage unit (not shown) for storing a plurality of message data fields DATA\_S which are obtained by segmenting input message data.

5

The user data field generator 420 generates a user data field by using the segmented message data fields DATA\_S received from the short message processor 406. The short message field generator 440 generates a data field in the form of a short message using the user data field. Finally, the transceiver retransmits the short message field which has been requested to be retransmitted.

Figure 5 is a block diagram of a data receiving apparatus according to an embodiment of the present invention. Referring to Figure 5, the data receiving apparatus includes a transceiver 502, a service identification unit 520, a connected short message processor 54 and an ordinary short message processor 580. The connected short message processor 54 includes a short message field translator 542, a short message storage/connection unit 544, a retransmission request short message number generator 546, a user data field generator 548 and a short message field generator 550.

25

In the operation of the receiving apparatus, the service identification unit 520 checks the user data field 602 of a delivery short message field 60 and extracts a data connection service identifier DATA\_CON\_SERVICE ID(0). The service identification unit 520 then generates a logic high control signal if the extracted data connection service identifier DATA\_CON\_SERVICE ID(0) corresponds to a predetermined code such as 98H or 99H and, if not,

30

generates a logic low control signal. The data connection service identifier DATA\_CON\_SERVICE ID(0) is suitably expressed using a code, which is not used in the KS5601 standard or the ASCII code table.

5

The short message field translator 542 translates data CHARi corresponding to a short message area in the user data field 602 and extracts a field TOTAL\_SM indicating the number of entire short messages and a field CURRENT\_SM  
10 indicating a current short message number, in response to the logic high control signal. If the short message field translator 542 fails in extracting the data CHARi, it outputs a field indicating the number of a message data field which failed to be extracted.

15

After storing translated data fields corresponding to the number of entire short messages, the short message storage/connection unit 544 connects the data fields and outputs connected data to a higher processing layer.

20

The retransmission request short message number generator 546 receives the field indicating the number of message data field which failed to be extracted from the short message field translator 542, and outputs a  
25 retransmission request short message number field REQ\_RESEND indicating the number of a message data field which needs to be retransmitted. The user data field generator 548 receives the retransmission request short message number field REQ\_RESEND and generates a user data  
30 field including the retransmission request short message number field REQ\_RESEND. The short message field generator 550 generates a short message field using the user data field. The transceiver 502 transmits the short

message field as a retransmission request delivery message over a channel.

On the other hand, if the data connection service  
5 identifier DATA\_CON\_SERVICE ID(0) is not the predetermined code such as 98H or 99H, the ordinary short message processor 580 performs ordinary short message processing in response to a logic low control signal.

10 Figures 7A and 7B show examples of message transmission procedure according to a short message transmission protocol using short message service according to an embodiment of the present invention. In these examples, a message composed of three pieces of  
15 short message data is transmitted over a channel.

An originating terminal inserts 98H into a data connection identifier (ID) field, 99H into a reference number field, 3 into a total number of short messages  
20 field and 1 into a current short message number field to make a collection message and sends the collection message. A short message center does not check a new data protocol format of user data but transmits the short message as it is to a destination terminal. The  
25 destination terminal receives the short message and checks the short message to determine whether a first byte of a user data field, namely, a data connection service ID, is 98H or 99H. If it is determined that the data connection service ID is 98H or 99H, the destination terminal  
30 extracts a field indicating the total number of short message and a field indicating a current short message number for the operation of the data connection service, and receives all of the short messages corresponding to

the number of short messages. As shown in Figure 7A, the originating terminal sequentially sends collection messages respectively including user data fields in which the current short message number fields are set to 1, 2  
5 and 3, respectively. The destination terminal sequentially receives the collection messages from the short message center. The destination terminal stands by for a predetermined time after checking the data connection service ID to receive as many short messages as  
10 the number which is extracted from the field indicating the total number of short messages.

However, the destination terminal may not receive a collection message sent from the originating terminal. In  
15 this occasion, the destination terminal inserts the number of the short message which is not received into a user data field, generates a short message field using the data field, and sends the short message field as a collection message to the short message center.

20 The originating terminal receives the retransmission request through the short message center. Then, the originating terminal retransmits the short message, which was not received by the destination terminal, in the form  
25 of a short message field. If the short message which was requested to be retransmitted is not received by the destination terminal within a predetermined time, the destination terminal discards the short messages which has been received before and is restored to an idle mode.

30 Consequently, a data transmission protocol according to the preferred embodiment of the present invention allows transmission of data, such as a simple picture or a



rough sketch, the volume of which cannot be transmitted by a conventional short service, while using a short message center. Therefore, various data can be transmitted using the short message service when employing the data transmission protocol. In addition, the short message center does not need to be changed.

The data transmission protocol and apparatus as described above can be made into programs which can be executed in a computer and this will be understood by those skilled in the art. The programs can be read from a computer-readable medium and executed by a common digital computer system. The computer-readable medium covers a storage medium such as a magnetic storage medium, e.g., ROM, a floppy disk or a hard disk, an optical readable medium, e.g., CD-ROM or DVD, or carrier wave, e.g., transmission through the Internet. Functional programs, code and code segments for the implementation of the present invention can be easily produced by programmers in this field.

**Claims**

1. A data sending protocol using a short message service, the data transmission protocol comprising the  
5 steps of:

(a) inserting a data connection service identifier into a user data field;

10 (b) segmenting input message data into a plurality of short message data fields and inserting a segmented message data field, a field indicating the number of segmented short messages and a field indicating a current short message number, into the user data field;

15 (c) generating a short message field using the user data field; and

(d) transmitting the short message field.  
20

2. The data sending protocol of claim 1, wherein the step (a) uses a code, which is not used in an ASCII code table, for the data connection service identifier.

25 3. The data sending protocol of claim 1, wherein the step (a) uses a code, which is not used in a KS5601 standard, for the data connection service identifier.

4. The data sending protocol of claim 2 or 3, wherein  
30 the code is 98H or 99H.

5. The data sending protocol of any of claims 1 to 4, further comprising a step of (e) inserting a reference

number field, which indicates a number for referring to the type of data connection service, into a position next to the data connection service identifier in the user data field.

5

6. The data sending protocol of any of claims 1 to 5, further comprising a step of (f) translating a delivery message and extracting an identifier requesting retransmission of data.

10

7. The data sending protocol of claim 6, wherein the step (f) comprises a step of (f-1) extracting a field indicating the total number of short message and a field indicating a retransmission request short message number.

15

8. The data sending protocol of claim 7, wherein the step (f) further comprises the steps of:

(f-2) inserting, among the whole segmented short messages, a short message data field corresponding to the retransmission request short message number, into a user data field; and

(f-3) generating a short message field using the user data field and retransmitting the short message field.

25

9. A data receiving protocol using short message service, the data receiving protocol comprising the steps of:

30

(a) checking a user data field of a delivery short message to extract a data connection service identifier;

if the data connection service identifier satisfies a predetermined condition,

(b-1) translating data in a short message area among  
5 the user data field of the delivery message; and

(b-2) storing and connecting a plurality of translated data; or

10 if the data connection service identifier does not satisfy a predetermined condition,

(c) performing an ordinary short message process.

15 10. The data receiving protocol of claim 9, wherein the step (b-1) comprises a step of (b-1-1) extracting a field indicating the total number of short message and a field indicating a current short message number, and the step (b-2) comprises a step of (b-2-2) outputting the  
20 connected data to a higher processing layer after storing and connecting as many data fields as the total number of short message.

11. The data receiving protocol of claim 9, if  
25 extraction of the data in the short message area fails in the step (b-1), further comprising the steps of:

(b-1-2) inserting a short message number of a field, in which extraction of the data fails, into a user data  
30 field as a retransmission request short message number; .

(b-1-3) generating a short message field using the user data field; and

(b-1-4) transmitting the short message field.

12. The data receiving protocol of claim 11, wherein  
5 the step (b-1-2) expresses short message numbers of fields  
whose data extraction fails, as retransmission request  
short message numbers, and inserts the retransmission  
request short message numbers into the user data field at  
one time.

10

13. The data receiving protocol of claim 10, wherein  
the step (a) extracts a code, which is not used in an  
ASCII code table, as the data connection service  
identifier.

15

14. The data receiving protocol of claim 10, wherein  
the step (a) extracts a code, which is not used in a  
KS5601 standard, as the data connection service  
identifier.

20

15. The data receiving protocol of claim 13 or 14,  
wherein the code is 98H or 99H.

16. A data sending apparatus using a short message  
25 service, the apparatus comprising:

data connection service identifier inserting means for  
inserting a data connection service identifier into a user  
data field;

30

short message processing means for segmenting input  
message data into a plurality of short message data fields  
and inserting a segmented message data field, a field

indicating the number of segmented short messages and a field indicating a current short message number, into the user data field;

5        short message field generating means for generating a short message field using the user data field; and

transmitting means for transmitting the short message field.

10

17.        The data sending apparatus of claim 16, wherein the data connection service identifier inserting means uses a code, which is not used in an ASCII code table, for the data connection service identifier.

15

18.        The data sending apparatus of claim 16, wherein the data connection service identifier inserting means uses a code, which is not used in a KS5601 standard, for the data connection service identifier.

20

19.        The data sending apparatus of claim 17 or 18, wherein the code is 98H or 99H.

20.        The data sending apparatus of claim 16, further  
25 comprising reference number field inserting means for inserting a reference number field, which indicates a number for referring to the type of data connection service, into a position next to the data connection service identifier in the user data field.

30

21.        The data sending apparatus of claim 16, further comprising short message field translating means for

translating a delivery message and extracting an identifier requesting retransmission of data.

22. The data sending apparatus of claim 21, wherein  
5 the short message field translating means comprises means for extracting a field indicating the total number of short message and a field indicating a retransmission request short message number.

10 23. The data sending apparatus of claim 21, wherein the short message processing means receives a field indicating the total of segmented short messages and a field indicating a retransmission request short message number from the short message field translating means, and  
15 inserting a data field corresponding to the retransmission request short message number into a user data field; and the short message field generating means generates a retransmission short message field using the user data field.

20

24. A data receiving apparatus using short message service, the apparatus comprising:

service identifying means for checking a user data  
25 field of a delivery short message to extract a data connection service identifier, outputting a control signal having a first logic level if the data connection service identifier satisfies a predetermined condition, and, if not, outputting a control signal having a second logic  
30 level;

short message field translating means for translating data in a short message area among the user data field of

the delivery message, in response to the control signal having the first logic level;

short message storage/connection means for storing and  
5 connecting a plurality of translated data; and

ordinary short message processing means for performing an ordinary short message process in response to the control signal having the second logic level.

10

25. The data receiving apparatus of claim 24, wherein the short message field translating means comprises means for extracting a field indicating the total number of short messages and a field indicating a current short  
15 message number, and the short message storage/connection means comprises means for outputting the connected data to a higher processing layer after storing and connecting data fields as many as the total number of short message.

20 26. The data receiving apparatus of claim 24, further comprising:

retransmission request short message number inserting means for outputting a field indicating a short message  
25 number of a field, in which extraction of the data fails, and inserting the field indicating the short message number of the field in which extraction of the data fails, into a user data field as a retransmission request short message number, if extraction of the data in the short  
30 message area fails;

user data field generating means for generating a short message field using the user data field; and



transmitting means for transmitting the short message field.

27. The data receiving apparatus of claim 24, wherein  
5 the service identifying means extracts a code, which is not used in an ASCII code table, as the data connection service identifier.

28. The data receiving apparatus of claim 24, wherein  
10 the service identifying means extracts a code, which is not used in a KS5601 standard, as the data connection service identifier.

29. The data receiving apparatus of claim 27 or 28,  
15 wherein the code is 98H or 99H.

30. A data sending apparatus substantially as  
hereinbefore described with reference to Figure 4 of the  
accompanying drawings.

20

31. A data receiving apparatus substantially as  
hereinbefore described with reference to Figure 5 of the  
accompanying drawings.



Application No: GB 0001656.8  
Claims searched: 1-29

Examiner: Anita Keogh  
Date of search: 15 August 2000

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.R): H4L (LDGP, LDGX, LDLX, LDLS, LDPP, LED), H4P (PPEC)  
Int Cl (Ed.7): H04L (1/16, 12/08, 29/06), H04Q (7/22, 7/32)  
Other: Online: WPI, JAPIO, EPODOC

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0840531 A2 (NOKIA) see whole document, particularly abstract and column 2 lines 14-22	9, 24 at least
X	EP 0777394 A1 (ALCATEL BELL) see whole document	1, 16 at least
A, E	WO 00/28750 A2 (ERICSSON) see whole document, particularly claim 3	1, 16 at least
X, P	WO 99/29128 A1 (ERICSSON) see whole document, particularly page 3 line 22 to page 7 line 5 and figures 5-8	1, 9, 10, 16, 24, 25 at least
A	US 4975952 (MABEY et al.) see whole document	6, 7, 8, 11, 12, 21, 22, 23, 26

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